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DIVISION OF ENGINEERING SERVICES
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METHOD OF TEST FOR OPTIMUM BITUMEN CONTENT (OBC) FOR OPEN GRADED FRICTION COURSE

A. SCOPE

This test method describes the procedure for determining the optimum bitumen content (OBC) for open graded friction course (OGFC) by examining the amount of asphalt drain down of an aggregate and unmodified asphalt binder mixture. This OBC should provide sufficient asphalt film thickness to provide good durability and avoid excessive asphalt drainage during production and placement. The procedure is used for OGFC with unmodified asphalt binder, polymer modified asphalt binder (PG-PM), and tire rubber modified asphalt binder (PG-TR), or asphalt rubber binder (ARB).

B. REFERENCES

California Test 206 – Specific Gravity and Absorption of Coarse Aggregate
California Test 207 – Specific Gravity and Absorption of Fine Aggregate
California Test 308 – Bulk Specific Gravity and Density of Compacted Hot Mix Asphalt

C. APPARATUS

1. Extraction Thimbles: 3 extraction thimbles as shown in Figure 1 and 2.
2. Aluminum Discs: 6 aluminum discs, $5\frac{1}{2}$ in. $\pm \frac{1}{16}$ in. diameter by a nominal thickness of $\frac{1}{16}$ in.
3. Cylindrical Steel Blocks: three 4000 g \pm 5 g steel blocks for applying load (3 in. nominal diameter \times $4\frac{1}{2}$ in. high steel block recommended).
4. Sample Mixing Apparatus: a mechanical hot mix asphalt (HMA) mixer is recommended, but hand mixing is permissible.
5. Oven: an oven capable of maintaining a temperature of $275^{\circ}\text{F} \pm 9^{\circ}\text{F}$.
6. Balance: a balance or scale with a minimum weighing capacity of 5000 g and accurate to 0.1 g.

D. SAMPLES

This test requires nine 1500 g aggregate samples to be mixed with unmodified asphalt binder.

1. Three of the 9 samples should be mixed at an approximate bitumen ratio (ABR) by dry weight of aggregate; 3 at ABR -0.7 %, and 3 at ABR +0.7 %. The ABR can be determined based on past experience with the aggregate or use 5.5 % as ABR if the aggregate has not been used before.
2. Prepare samples at the aggregate gradation (individual sieve size fractions) proposed for sizes retained on the No. 16 sieve.

Split or quarter the passing No. 16 sample portion and add the required weight to give a total representative sample of 1500 g.

3. For mixes using unmodified asphalt binder, use the binder that will be used during production to determine OBC.

For mixes using PG-PM or PG-TR use PG 64-10 asphalt binder from the same source as the base stock of the modified binder to determine OBC.

For mixes using ARB use asphalt binder of the same grade and from the same source as the base stock of the ARB to determine OBC.

E. TEST PROCEDURE

1. For each group of 3 of the 1500 g samples having the same binder content, heat the aggregate and the asphalt binder to $275^{\circ}\text{F} \pm 9^{\circ}\text{F}$.
2. Place an aluminum disc in the bottom of each extraction thimble as shown in Figure 1 and attach the screw-on bottom so that the aluminum disc is firmly held in place.
3. Tare each extraction thimble with the bottom disc assembly in place.
4. Preheat 3 extraction thimble assemblies, 3 top discs and 3 cylindrical steel blocks in an oven at $275^{\circ}\text{F} \pm 9^{\circ}\text{F}$ for a minimum of 15 min.
5. Mechanically mix or hand mix the 3 individual samples of aggregate and asphalt binder for $2 \text{ min} \pm 5 \text{ s}$. Mix over a heat source such as an infrared lamp or a hot plate to avoid loss of temperature.
6. After mixing, immediately transfer each mix into a heated extraction thimble assembly. Use a spatula to scrape clean the insides of the mixing bowl or pan.
7. Place an aluminum disc on top of each mix (Figure 1).
8. Place a cylindrical steel block on top of each disc (Figure 1).
9. Place each of the 3 assembled samples into an oven maintained at a temperature of $275^{\circ}\text{F} \pm 9^{\circ}\text{F}$ for $30 \text{ min} \pm 15 \text{ s}$.

NOTE: Organize the samples in the oven to accommodate removal at the prescribed 30 min.

10. Remove the sample from the oven, remove the cylindrical steel block and top disc, invert the thimble, and dump the test specimen into a pan. Tap the bottom of the thimble assembly 10 times with the spatula handle to dislodge any loose material. Remove aggregate particles larger than No. 8 from the thimble assembly.
11. Allow the thimble and bottom disc assembly to cool to room temperature for a minimum of 20 min.
12. Reweigh each thimble with the bottom disc assembly in place to determine grams of asphalt drainage as follows:

Grams of asphalt drainage = Reweigh weight – tared weight (Section E.3)

Average the results of asphalt drainage from the 3 samples.

13. Repeat Steps 1 through 12 with test specimens prepared using other asphalt contents.
14. Plot the average drainage for each asphalt content on the form in Figure 3 and connect the successive points using a straight edge.
15. At the intersection of this line with 4.0 g maximum drainage line on the abscissa, read the asphalt content from the ordinate. Report this value as OBC_1 .

NOTE: If this line does not intersect with the 4.0 g maximum drainage line, adjust binder content and make 3 more specimens for determining amount of asphalt drainage by repeating Steps 1 through 15.

F. CALCULATIONS

1. OBC of mixes using unmodified asphalt, PG-PM or PG-TR: Use OBC_1 as determined in Section E.

$$OBC = OBC_1$$

2. OBC of mixes using ARB: Use OBC_1 as determined in Section E with the following modifications:

For rubberized hot mix asphalt – open graded (RHMA-O):

$$OBC = OBC_1 \times 1.4$$

For rubberized hot mix asphalt – open graded high binder (RHMA-O-HB):

$$OBC = OBC_1 \times 1.65$$

G. REPORTING OF RESULTS

Report OBC and OBC_1 , bulk specific gravity of coarse aggregate (California Test 206), bulk specific gravity of fine aggregate (California Test 207), bulk specific gravity and density (unit weight) (California Test 308, Method B), and the asphalt binder grade and source on Figure 3 (Form TL-601).

H. HEALTH AND SAFETY

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

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(California Test 368 contains 6 pages)

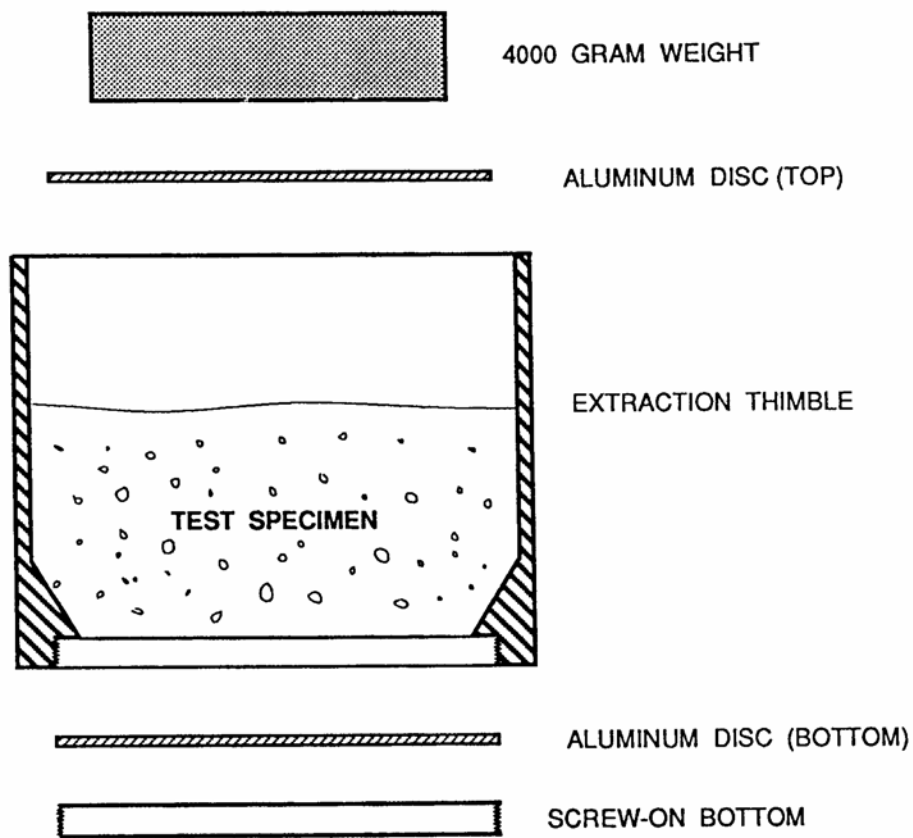


FIGURE 1. Equipment Assembly

Original Drawing available from
Translab.

Contact:

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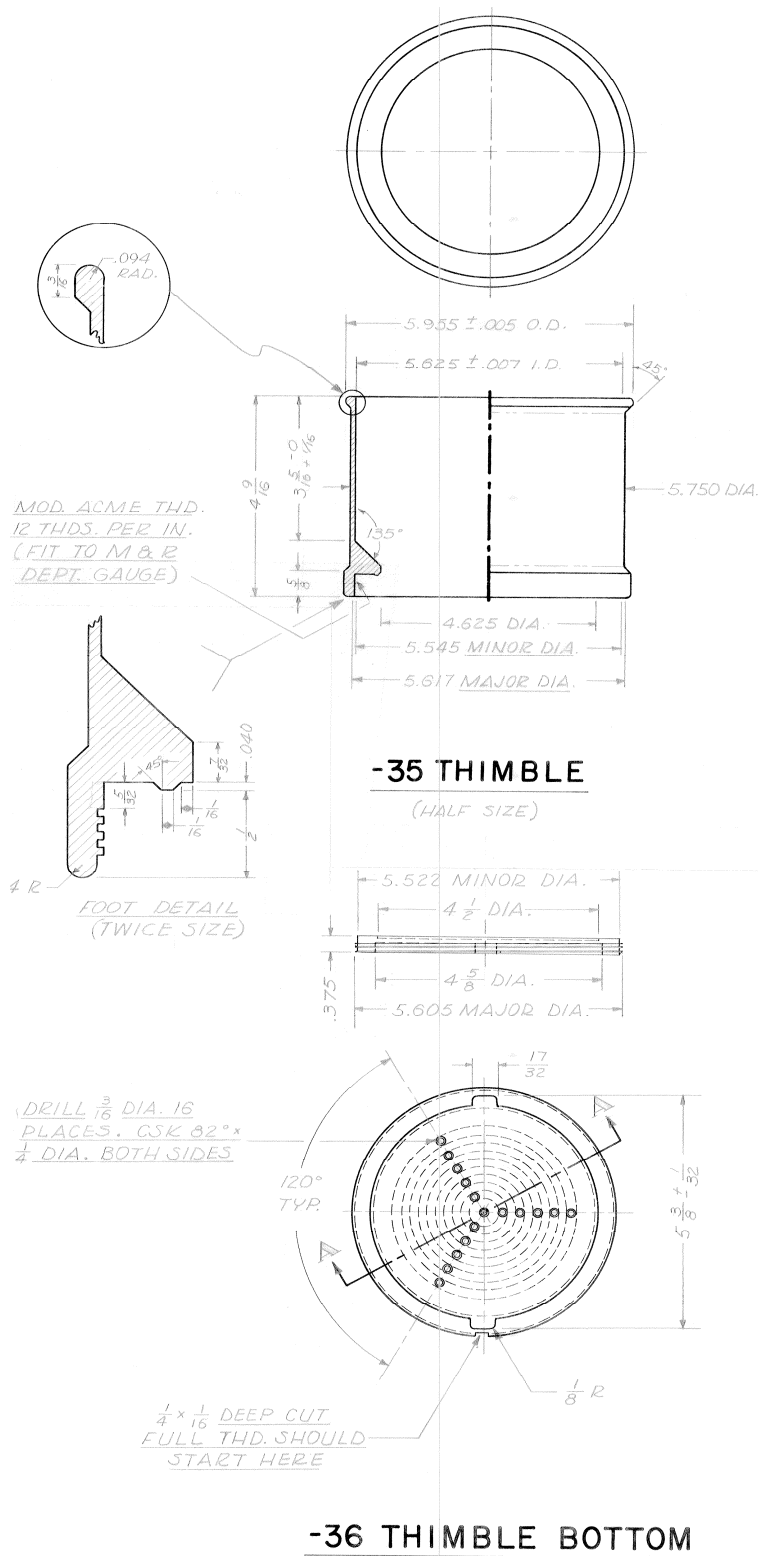


FIGURE 2. Plan Drawings of Thimble Assembly

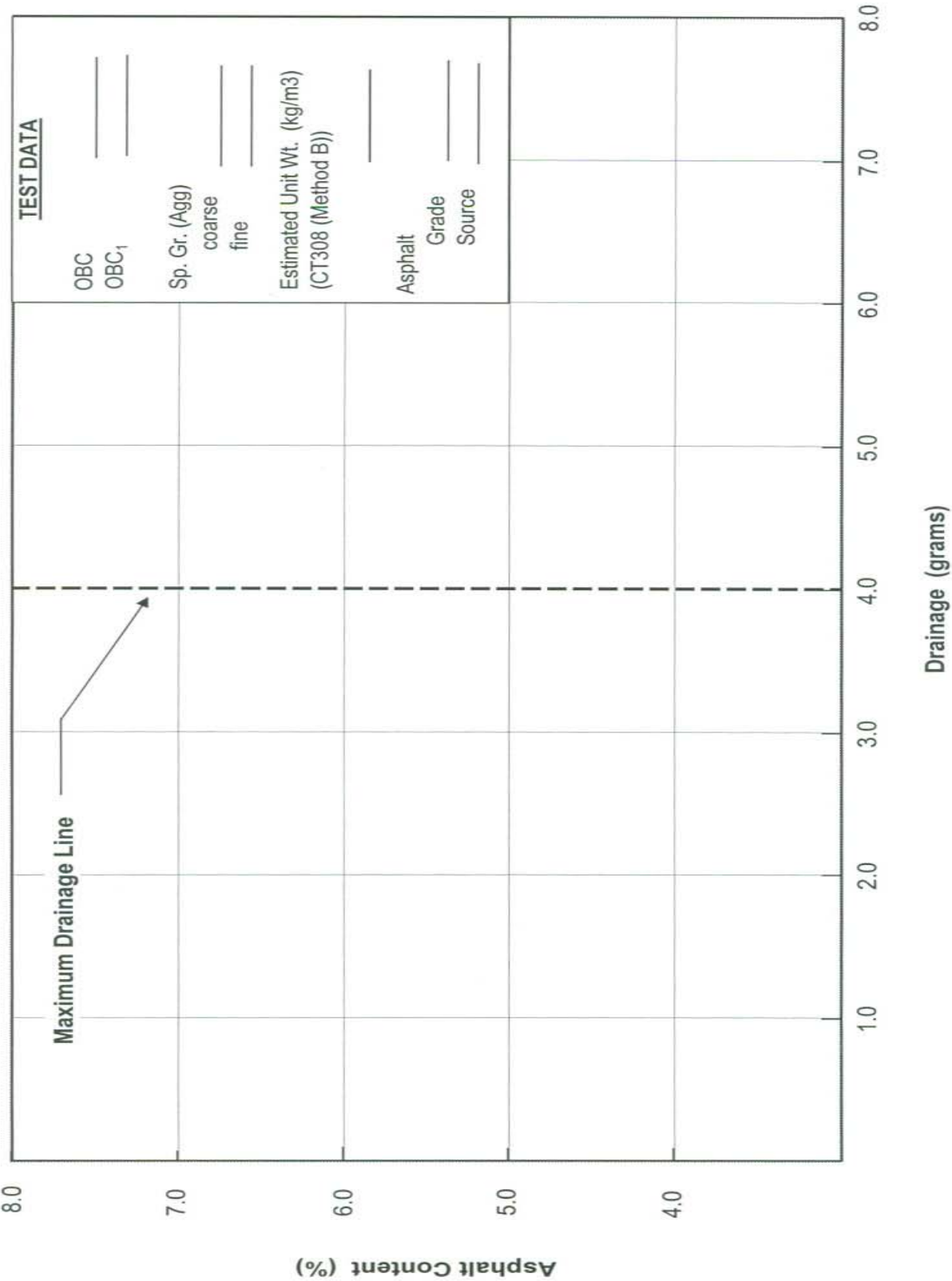


FIGURE 3. Open Graded OBC Worksheet